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Perception of Cotton Farmers on the Effects of Pesticide Use

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Authors' contributions

This work was carried out in collaboration between both authors. Authors AB and KUD designed the study, wrote the protocol and first draft of the manuscript. Author AB managed literature searches, data collection and analyses of the study. Both authors read and approved the final manuscript.

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ABSTRACT

Pesticide use is said to have contributed significantly to the food security though, with the decline in crop production and post-harvest losses, there is a growing concern over the ill effect of pesticides on human and animal health, environment, natural resources and sustainability of agriculture production. The farmers in Dharwad district of Karnataka are under the misconception that higher returns could be gained through the use of high doses of pesticides. However, this has resulted in pest resistance, pest resurgence and secondary pest outbreaks in the region over the past few years and farmers are only unaware of short-term ill effects of pesticides. Likert scaling, which is the most widely used psychometric scale in survey research, was used to study the perception of cotton farmers on pesticide use and Chi-square test was done to study the relationship between levels of perception and independent variables. Almost 90.83 percent respondents felt that the pesticide use affects human health. Approximately, 52.50 percent accepted the fact that pesticide kills other organisms and only 10 percent of the respondents neglected it. When asked further about the loss of biodiversity, soil, air and water contamination, pesticide drift and pest resurgence, the majority of the respondents didn't know anything about it, i.e. 48.33 percent, 52.50 percent, 60 percent and 55 percent respectively.

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1. INTRODUCTION

Cotton accounts for about 16 percent of global insecticide usage. Almost one kilogram of hazardous pesticides is applied for every hectare under cotton. A total of one to three percent of agricultural workers worldwide suffer from acute pesticide poisoning with at least one million requiring hospitalization each year [1]. Over the past decade, the perplexities in cotton pest management intensified with more and more insect species developing resistance to insecticides which was a consequence of the excessive use of insecticides rendering insecticides ineffective, wastage of resources and consequent environmental pollution.

Farmers are directly involved in the handling of pesticides, are at a high risk through contact with pesticide residues on treated crops, unsafe handling, storage and disposal practices, poor maintenance of spraying equipment, and the lack of protective equipment or failure to use it properly [2,3]. Observational studies of those who work with pesticides have revealed traces of pesticide residues in blood samples of cotton farmers [4,5]. Cotton undoubtedly represents one of India's most important economic, nutritive and cultural commodities, but its conventional cultivation has become deeply problematic, because of the external costs of its impact on health and environment [1].

Pesticides represent one of the major environmental and public health problems all over the world [6,7]. In particular, inappropriate use of pesticides has been linked with: (1) adverse effects on non-target organisms (e.g., reduction of beneficial species populations), (2) water contamination from mobile pesticides or from pesticide drift, (3) air pollution from volatile pesticides, (4) injury on non-target plants from herbicide drift, (5) injury to rotational crops from herbicide residues remained in the field, (6) crop injury due to high application rates, wrong application timing or unfavorable environmental conditions at and after pesticide application [8,9]. About 19.4 percent of the respondents had experienced negative side effects on health after handling pesticides. The symptoms include headache, weakness, dizziness, fever, blurred vision, and nausea/vomiting. Most of the respondents are aware of pesticide-related symptoms and possible routes of absorption

during application of pesticides. Farmers make only short-term assessments of pesticides and spray these chemicals without taking proper protective clothing [10].

Visualizing the importance of these issues, the present study, therefore, is an attempt in this direction and likely to highlight various issues relating to pesticide usage in cotton production. The specific objective was to study farmers perception on pesticide use. It was carried out with an interview schedule, clear statements about health effects, environment, pest resistance, pest resurgence were asked to the farmers directly of Dharwad district of Karnataka.

2. METHODS

In Karnataka, cotton is grown in 8,75,000 hectare with 23,12,000 bales of production and 1793 metric tonne of pesticide consumption during 2014-15. Dharwad district of Karnataka, occupying an area of 90,497 ha under cotton was purposively selected for the present study. Three taluks i.e. Navalgund, Kundagol and Hubli were selected based on maximum area under cotton cultivation. Two villages from each taluk were selected based on the highest number of cotton farmers and maximum area under cotton. Twenty cotton farmers from each village were post-stratified into small, medium and large farmers proportionately making a total sample of 120. Primary data on various aspects of sample farmers for 2016-17 agricultural year was collected through field survey by the interview and recall memory method with the help of a pre-tested and well-structured schedule in the month of November and December 2016. Simple averages and percentages were calculated for tabulation of the collected data. Likert scaling, which is a psychometric scale is the most widely used approach to scaling responses in surveys. This technique was used to assess the perception of farmers on the effects of pesticide use in cotton. The response to each perception aspect was recorded as strongly agree (5), agree (4), neutral (3), disagree (2) and strongly disagree (1). To get an overall perception, total scores of all five responses were summed up into three major levels high (45-60), medium (29-44) and low (12-28) perceptions. The relationship between the levels of perception and independent variables was tested using Chi-square test in SPSS version 16.0.

3. RESULTS

Farmer's perception towards pesticide externalities and health effects was measured in relation to cultural, mechanical and chemical plant protection aspects by Likert scaling. Answer categories for these statements were based on a five-category Likert scale, going from 1 (Strongly Disagree) to 5 (Strongly Agree). The survey results are presented in Table 1.

Almost all respondents interviewed believed that it is important to use pesticides wisely because of its harmful effects on human and environment. This is a welcome finding from the perspective of reducing the hazards of pesticides. About 9.16 percent strongly agreed and 81.16 percent agreed that the pesticide use cause effects on human health. The respondents were well aware that pesticides are harmful to the environment and human health. Approximately, 4.16 percent strongly agreed and 48.33 percent agreed the fact that pesticide kills other organisms (e.g. beneficial insects, birds, earthworms and fish), only 8.33 percent and 5.83 percent of respondents neglected the fact. When asked further about loss of biodiversity, soil, air and water contamination, pesticide drift and pest resurgence, the majority of respondents didn't know anything about it, i.e. 48.33 percent, 52.50 percent, 60.00 percent and 55.00 percent respectively. Most of the respondents agreed that pesticide contamination is due to misuse of pesticides, i.e. 25.00 percent strongly agreed and 37.50 percent agreed. Regarding the fact that also pesticide is the solution for pest problem, i.e. 27.50 percent and 41.66 percent strongly agreed and agreed respectively. 8.33 and 37.50 percent strongly agreed and agreed to the fact that use of pesticides increases levels of crop yield. Many respondents were in the habit of eating, drinking and smoking during spraying, 45.00 percent of farmers didn't know about pesticide toxicity. Most of the respondents were unaware of the long-term effects of pesticide use and disagreed and strongly disagreed with it were 40.00 and 24.16 percent, 37.50 and 25.00 percent experienced short-term illness.

To get an overall perception, total scores of all five responses were summed up into three major levels, i.e. High (45-60), Medium (29-44) and Low (12-28) perceptions. The relationship between the levels of perception and the different size group farmer was found to be a positive relationship, with Pearson Chi-Square value of 10.91. Factors that had positive relationship

were different size group farmer, age, education, family size, family type and income. Factors significant at one percent were age and income.

From Table 2, higher the income level, higher was the level of perception and hence these farmers had taken proper precautions and used protective clothing. Factors significant at five percent were different size group farmer and education, where small farmers had low perception than large farmers.

Similar results were also found in [11] where the Chi-square results showed that age, education, farming experience and extension contact variable were the significant factors associated with farmers' perception. However, household size had no significant relationship with farmers' perception.

Similar results were found with [12] in their study where most of the farmers were unaware of the ill effects of pesticides on human health and their opinion was that pesticides are less effective and this makes them to overuse pesticides. Farmers awareness about long-term effects was very low, with about 11 percent of the sample population having an understanding of the short term as well as long-term effects of pesticides while 36 percent and 53 percent are in low and medium level of perception. A positive relationship was seen in case of age of crop, income and farming type and negative relationship in case of education, experience, labour, land extent and price of pesticide with farmers level of perception.

4. DISCUSSION

From the above Likert scaling technique, almost all respondents interviewed believed that it is important to use pesticides wisely because of the harmful effects on human and environment, and most of them also accepted the fact that pesticide kills other organisms. Majority of the respondents didn't know anything about loss of biodiversity, soil, air and water contamination, pesticide drift and pest resurgence but were of the opinion that pesticides are inevitable. Farmers were unaware of long-term effects of pesticides on health, beneficial insects, predators, crop and livestock because of less education and awareness they had, but they were aware of short-term illnesses due to often pesticide exposure. Most of the farmers were of the opinion that pesticides found nowadays were

Table 1. Farmers' perception on pesticide use

S.No	Farmers percep.	Strongly agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Str. disagree (1)
1	Pesticides can cause damage to human health	11 (9.16)	98 (81.16)	7 (2.5)	3 (2.5)	1 (0.83)
2	Pesticides will not only reach the target organisms but will also kill other organisms (e.g. beneficial insects, birds, earthworms, fish) in and around the crop fields	5 (4.16)	58 (48.33)	45 (37.50)	10 (8.33)	2 (1.66)
3	Pesticides cause loss of biodiversity, deaths of wildlife, and death of farm animals.	3 (2.50)	30 (25.00)	58 (48.33)	22 (18.33)	7 (5.83)
4	Soil, air and water bodies can easily be contaminated with these poisonous chemicals	8 (6.66)	42 (35.00)	63 (52.50)	5 (4.16)	2 (1.16)
5	Spraying of pesticides during the hottest part of the day when volatilization or drift can damage other garden plants, including our neighbor's.	1 (0.83)	16 (13.33)	72 (60.00)	29 (24.166)	2 (1.66)
6	Pesticides usage causes resurgence of pest population after removing natural enemies.	3 (2.50)	24 (20.00)	66 (55.00)	24 (20.00)	3 (2.50)
7	A major factor of pesticide contamination is the misuse of pesticides	30 (25.00)	45 (37.50)	36 (30.00)	5 (4.17)	4 (3.33)
8	Pesticide use only solves pest problem	33 (27.50)	50 (41.66)	30 (25.00)	7 (0.58)	1 (0.83)
9	Use of pesticides increase levels of crop yield	10 (8.33)	45 (37.50)	40 (33.33)	23 (19.16)	2 (1.16)
10	Eating, drinking and smoking in the field causes increased pesticide toxicity	1 (0.833)	20 (16.66)	54 (45.00)	30 (25.00)	15 (12.50)
11	Long term negative effects of pesticides	5 (4.16)	10 (8.33)	28 (23.33)	48 (40.00)	29 (24.16)
12	Symptoms of acute poisoning with pesticides	30 (25.00)	45 (37.50)	34 (28.33)	7 (5.83)	4 (3.33)

Note: Figures in parentheses indicate percentage to the total

Table 2. Relationship between levels of perception and independent variables

S.No.	Independent variables	Pearson Chi-Square	Degrees of freedom	p values
1	Different size group farmer	10.91*	4	0.02
2	Age	12.88**	4	0.01
3	Education	15.93*	8	0.04
4	Family size	5.54	4	0.23
5	Family type	0.63	2	0.73
6	Income	19.46**	4	0.01

*- Significant at the 5per cent level. **- Significant at the 1per cent level

less effective and this persuades them to overuse pesticides. Farmer was under the misconception that higher returns could be gained through the use of high doses of pesticides. Factors influencing levels of perception were different size group farmer, age, education and income. Education is the most important factor to determine the level of perception and so higher the education of farmers, higher was their level of perception and even higher the income level, higher was the level of perception and hence educated and high income farmers had taken proper precautions and used protective clothing. Old aged farmers had high level of perception as they cared more about their health and large farmers were much aware of the effects of the pesticides than young aged and small farmers because of their experience.

5. CONCLUSIONS

The objective of this study was to assess farmers' perception of pesticide use. Almost 90.83 percent respondents felt that the pesticide use affects human health. Approximately, 52.50 percent accepted the fact that pesticide kills other organisms and only 10 percent of the respondents neglected it. When asked further about loss of biodiversity, soil, air and water contamination, pesticide drift and pest resurgence, the majority of the respondents didn't know anything. Farmers were found to have medium perception level. Most of the farmers in the study area were not aware of the health hazards caused by the pesticides and also the consequences of their improper handling. Moreover, the use of appropriate and well-maintained spraying equipment along with taking all the precautions required in all stages of pesticide handling could also reduce exposure to pesticides. To increase the farmer's knowledge and promote good farming practices, field-based agricultural training programs should be encouraged. Governments need to adapt or introduce regulations and policies that ensure that pesticide risks are minimized, that pesticide use is reduced and that alternative systems and methods are promoted. Regulations and policies need to be based on the latest available knowledge and decision making processes need to be transparent. Introducing restrictions on pesticide use and taxes that internalize external costs into the price of pesticides can foster innovation and the development of alternatives. Research and investments are needed in order to assess and

monitor impacts of pesticide use and to develop alternatives.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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